IMPACT OF IMPORT DEMAND ON SOCIAL WELFARE OF MAIN WHEAT IMPORTING COUNTRIES

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ABSTRACT

The main aim of this study is examination of import demand function and investigation of its effects on welfare by analyzing Simultaneous equation system during 1979 to 2008. In this study the results social welfare obtained using consumer surplus for the top four wheat importing countries (Algeria, Brazil, China and Egypt). The variable price of wheat export has a negative and significant effect on consumer surplus and social welfare that per one percent increase in wheat price elasticity, has reduced consumer surplus -1.11%, -0.5211%, -12.087% and -0.0002% for the four countries mentioned, that has been slacked the level of social welfare.

Key words : Wheat importing countries, Consumer surplus, Compensation change, Social welfare, Simultaneous equations.

INTRODUCTION

Wheat is one of the most important cereals in agriculture and is cultivated all over the world and has a specific guideline as the most necessary and vital product around the world which is used as a political tool in national terms in a way that can be even used in order to apply political pressure on the third world countries; further this product is known as an international business good because more than one fifth of its production exchanges around the world (McIntosh and Wetzstein, 1995).

The purpose of this study was to estimate consumer surplus rate and social welfare in Algeria, Brazil, China, and Egypt by price elasticity and income elasticity from assessing demand import model and the effect of demand import on consumer and social welfare in these countries are examined according to increase or decrease in export prices.

MATERIALS AND METHODS

A: Import Demand Model

The project has been carried out in Agricultural Economics Department of University of Zabol-Iran during 2010/02 to 2010/09. Also, in order to assess import demand model the linear logarithmic model consist’s of three equations from study of C Kong et al, (2009) and new original article as follows:

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\[ \sum_{i} \log(IM_{it}) = (1) \]
\[ \alpha_1 + \alpha_2 \sum_{i} \log(GNI_{it}) + \alpha_1 \log(DWP_{it}) + \varepsilon_i \]
\[ \log(DWP_{it}) = (2) \]
\[ b_1 + b_2 \sum_{i} \log(CON_{it}) + b_3 \log(DWP_{it}) + b_4 \log(DMP_{it}) + \varepsilon_i \]
\[ \sum_{i} \log(GNI_{it}) = (3) \]
\[ C_0 + C_1 \sum_{i} \log(GDP_{it}) + C_2 \sum_{i} \log(FDI_{it}) + C_3 \sum_{i} \log(DP_{it}) + C_4 \sum_{i} \log(POP_{it}) + \varepsilon_i \]

Where:

- **IM_{it}**: is the import volume of wheat for importing country i in period t.
- **GNI_{it}**: is the gross national income for importing country i in period t.
- **DWP_{it}**: is the domestic wheat price in period t.
- **\varepsilon_i**: is the random error term.
- **CON_{it}**: is the Wheat consumption for importing country i in period t.
- **Oilt**: is the Annual average of oil price in the U.S in period t.
- **DRP_{it}**: is the domestic rice price in period t.
- **DMP_{it}**: is the domestic maize price in period t.
- **GDP_{it}**: is the real gross domestic product for importing country i in period t.
- **FDI_{it}**: is the Average foreign direct investment of importing country i in period t.
- **IN_{it}**: is the Average of inflation rate of the importing country i in period t.
- **POP_{it}**: is the Average population rate of importing country i in period t.

Coefficients \(\alpha_1\) and \(\alpha_2\) are income elasticity and price elasticity import demand \(\alpha_2 < 0\) and \(\alpha_1 < 0\).

And the coefficient of two other equations are as follows:

\[ b_1 > 0, b_2 > 0, b_3 < 0, b_4 > 0, C_1 > 0, C_2 < 0, C_3 > 0, C_4 > 0 \]

Equation (1) is estimated at the same time from equation system at the same time in three ways, OLS(ordinary least squares)1, SUR(seemingly unrelated regression)2, IV/GMM(instrumental variable with generalized method of moment)3 by Eviews (6) software. The reason of IV/GMM and SUR estimation is the presence of correlation between gross national income and domestic wheat price which leads to incompatible estimations and finally leads to inefficiency of cost accountant OLS. In order to solve this problem IV/GMM is applied, but the estimation of equations (2) and (3) by OLS In uncorrelated regression equation system it is assume that equation disorder terms are related to each other or it is said that they have simultaneous correlation as:

\[ E(\varepsilon_i, \varepsilon_j) = \delta_{ij}I_T (4) \]

It means that the above disorder terms are affecting by equal forces and features, besides there are usually several limits among equation parameters in OLS which is known as inter equation limits (Zellner, 1962). The IV/GMM method is used in order to eliminate the correlation of disorder term which is due to multiple period expectations and it makes it possible for creating reliable statistic deductions (Abrishami, 2002). Since examining variable stagnation is the first step in time series variants analysis and if there is no stagnation variable exists, or in the other words if the distribution possibility of that variable changes, regression analysis will encounter difficulty. This time statistical method declines inconsistence assumption. The generalized test (Dicky Fuller) is used for examining variable stagnation in this study. Another test, which examined in this study, is Johanson, Joe Cilious collective test. The concept of collective economics is that when two or more time series variable are related by the theoretical principles in order to form a long term equilibrium relation, while these time series might be inconsistent, but they follow each other during the time in a way that difference between them is stagnated. Effect and maximum tests of specific rates are used for rank or number of collective vectors determination. The effect test examines the zero assumption which says that the amount of collective vectors is less than or equal to \(r^*\). Maximum test examines the specific amount of
zero assumption which says that the number of collective vectors \( r^* \) is against opposite assumption of collective vector \( r^*+1 \) (Noferesty, 1999).

**B: Social welfare**

Examining created changes in social welfare, especially consumer surplus is required according to wheat price fluctuations. Consumer surplus is the difference between the maximum price that consumer tends to pay and market price. Due to figure 1, consumer surplus in geometrics is the area under demand round and the area above the market price. Since it is not possible to directly estimate consumer surplus, there is a need to know the reparative change which is infect the maximum price that a consumer tends to pay for the maximum price he achieves (Just, et al, 2002). That relation between consumer surplus, compensation change and social welfare has been shown in the form figure 1 that derived from research (Kong et al, 2009).

In figure 1, \( u_1 \) is the consumer utilization on the price of \( p_1 \), \( u_2 \) is the consumer utilization on the price of \( p_2 \), \( D(y_1) \) is the Marshal demand on \( y_1 \) income, \( H(U_1) \) is the procedure of estimating consumer surplus and reparative change is due to equation (1) and (2) and it is as follows:

According to the result from estimation of demand import model by OLS the numeral amount of \( \hat{\alpha} = +3.22 \) and \( \hat{\alpha} = -0.3 \) are reached which are price elasticity and income elasticity in equation (6). By placing \( \hat{\alpha} \) and \( \hat{\alpha} \) in equation (6) we can calculate the amount of consumer surplus. According to figure (1), the amount of consumer surplus includes \( A+B+C \) area. Reparative change is also

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<tr>
<td>Egypt</td>
<td>5952.2(86%)</td>
<td>5462.8 (71%)</td>
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<td>6673.2(67%)</td>
<td>4674.4(15%)</td>
<td>5596.6(11%)</td>
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<td>12522.8(31%)</td>
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<td>11240.8(39%)</td>
<td>2298(30%)</td>
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<td>4237.4(92%)</td>
<td>6603(81%)</td>
<td>2974.4(15%)</td>
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<td>5152.2(12%)</td>
</tr>
<tr>
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<td>5112.8(12%)</td>
<td>5721(13%)</td>
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Sources: Research findings.

| Table 1 : Estimation average import volume from 1979-2008. |

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Sources: Research findings.

| Table 2 : Demand model’s coefficient for wheat importing countries. |
|---|---|---|---|
| Independent variable | OLS | IV/GMM | SUR |
| Log ( gross national income) | -0.3**(-2.211) | -0.3-(2.211) | -0.236**(-2.451) |
| Log (domestic wheat price) | 3.223**(2.213) | 3.223(1.583) | 3.486**(2.532) |
| R²The number of observation | 0.7830 | 0.9430 | 0.9430 |

Source: Research findings.

| Table 3 : Result of estimating equation (2) and (3). |
|---|---|---|---|
| Log(DWP_i) = 0.31 + 0.0002log(con) + 0.411log(oil) - 0.002log(DRP_i) + 0.81log(DMP_i) |
| (0.04)** | (0.57)** | (0.231) | (0.91) |
| Log(GNI_i) = 7.6 + 0.84log(GDP_i) - 0.016log(FDI_i) + 0.0021log(inflation) + 0.54log(POP_i) |
| (0.03)**(0.001)** | (0.4) | (0.98) | (0.004)** |
| R²= 0.94 |

Source: Research findings. **significance.
calculated by placing $\alpha = +3.22$ in equation (8) which includes area (A+B) in figure (1) and welfare amount is estimated by the difference between consumer surplus and compensation change and welfare is shown in figure (1) which is the highlighted area.

Theoretical form of the compensation change that has taken from of Braynjolsson et al, model (2003), is as follow:

$$CV = e(p_0, u_1) - e(p_1, u_1)$$ (5)

Where:

$CV$ is compensation change, $P_0$ and $p_1$ are previous and new prices of current products and $u_1$ is utilization level.

Equation (5) includes cost function according to the utilization level. Thus, it describes reparative change by indirect utilization function. Linear standard logarithmic demand function is considered for applying indirect utilization function. Hix’s demand function is given from Houthakker and Magee, 1969).

$$X(P, y) = AP^\alpha y^\beta$$ (6)

Where $P$ is domestic wheat price, $Y$ is income, $\alpha$ is price elasticity, $\beta$ is income elasticity, $A$ is the constant part. Indirect utilization function is estimated by differentiating equation (6) and is as follows:

$$V(p, y) = -A \frac{p^{1+\alpha} y^{1-\delta}}{1+\alpha}$$ (7)

Reparative change equation is without considering utilization is:

$$CV = -y + \left[ \frac{1-\delta}{1+\alpha} y^{-\delta} (p_0 x_0 - p_1 x_1) + y^{1-\delta} \right]^{-\delta}$$ (8)

Where $X_0$, $X_1$ are previous and new products of current production. Equation (8) is summarized in the form of equation (9):

$$CV = -\frac{p_1 x_1}{1+\alpha}$$ (9)

This analysis is focused on wheat export changes in consumer surplus and it shows the incomes of wheat export price analysis. Brynjolsson et al, 2003 simple logarithm model (2003) is used for estimation that is as follows:

$$\log(c_t) = \alpha_0 + \alpha_1 \log(p_t)$$ (10)

Where $C_t$ is the consumer surplus during $t$, $P_t$ is export price of wheat during $t$, $\alpha_1$ is the export price elasticity on consumer surplus.

The data of this analysis were got from USDA and World Bank. Information basic includes information such as real GDP, FDI, GNI, and inflation rate and population growth. Price information is gotten from FAO basic which provides annual data of four importing countries (Algeria, China, Brazil, and Egypt) from 1979 to 2002. The data is used for estimating import demand equation and logarithm equation which includes consumer surplus and export price. In this paper Eviews (6) is used for estimating.

In Table 1, has been shown relative contribution wheat import volume for countries (Algeria, Brazil, China, and Egypt) based on world import volume.

RESULTS AND DISCUSSION

Beller and Hout (2006), is an excellent example of how combining the welfare state and social stratification literatures, along with careful attention to case selection and methodology, can result in new and exciting insights applicable to both disciplines. New and exciting insights applicable to both disciplines. Palme (2006), finds that countries with the more traditional, male-breadwinner model, mainly the continental European countries, seem to be less and less able to provide for child welfare. Mahmoudi (2004), analyzed the distribution of income and social welfare during the first developing program in Iran (1994-1979). He shows that there is long distance between income rates in urban and rural areas. The inequality of income is relatively high in Iran and it hasn’t changed during the first developing program, but it decreased in
urban areas and increased in rural ones in a way that this decrease and increase counteract each other in representing a general illustration of inequality. Further, during this period the rural welfare is decreased and the urban welfare is more. Haddad and Ahmad (2002), followed changes in poverty, welfare and consumption of consumers and also examined their effective factors in Egypt from 1997 to 1999. The resolutions of this study showed that two-third of poor people has a very low rate of consumption and approximately half of them had a poverty rate under the poverty line and education, the number of household members, value of assets, the number of children and the supervisor’s career are several factors. Weber (2003), showed that import tariff reduction by Russia causes the increase in food import from Kazakhsthan, this increase for each items of sugar, potato and chicken was 15%, 18% and 8%. It is also determined that according to the enfranchisement of export, vegetables, milk and meat will increase 2 to 4 percent. Mukherjee and Benson (2003), examined the change effect of several household features about poverty and prosperity with the purpose of recognizing poverty determination features in rural and urban areas in Malawi. In this study, the term between household features and their consumption rate was studied at first and different change scenarios effects about important traits on poverty change in typical households was examined. Resolutions showed that the increase on educational level and recuperation, especially women working out of agricultural section causes poverty in Malawi. Sayad–zadeh and Mehdi (2006) with description social welfare function Nyaasn statistics and with presentation an analysis empirical and theoretical turn to considered this function in Iran ,they mentioned that income and economy welfare always regarded economists and politicians and has been propounded different criterion for

Fig. 1 : The relation between consumer surplus and compensation change.
considered them. McCorriston and MacLaren (2005), that, in general, the granting of exclusive rights to an STE causes trade to be distorted when compared with an industry composed only of profit maximizing firms. In particular, it has been shown that an importing STE acts as equivalent to an import tariff and an exporting STE acts as equivalent to an export subsidy. Hejbar and Ahmad (2002), estimated demand functions and water and wheat production supply at the same time from 1971 to 1999. In their study the tensile price supply of wheat was positive and more than 1 which shows farmers intense elasticity to price changes.

**A: Model estimation**

Estimation results of model (1) on import demand is shown in table (2) by three ways: OLS, SUR and IV/GMM.

In Table 2, gross national income coefficient estimated by SUR is negative and statistically meaningful and its amount is -0.3, therefore income is tensionless in world wheat market and it statistically means that by each percent increase in gross national income, import amount is reduced up to 0.3 percent. Domestic wheat price is positive and statistically meaningful; therefore it is tensile and is equal to +3.223.

So, by each percent increase in domestic wheat price, import volume increases up to 3.223. Since the amount of price elasticity is positive and more than one, it shows the intense elasticity to price changes. Consuming increase can affect price of the current position.

The result from estimating two other equations by OLS system are as follows:

According to the result from Table 3, coefficients of oil price and consumption is positive and consumption coefficient is statistically meaningful and important, that is increase in oil price and consumption price leads to increase in domestic wheat price and decrease in domestic wheat consumption and this causes to increase import volume. Increase in consumption can affect the price of current position and oil price affects transportation costs which are related to theoretical cost. Economical growth enhancement can affect direct external investment and population can increase incomes of importing country and it says that economical and population growth are

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<th>Specific value</th>
<th>Maximum examination</th>
<th>Trace examination</th>
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<tr>
<td>Critical amount statistic in level 5%</td>
<td>Critical amount in level 5% statistic</td>
<td>H₁</td>
</tr>
<tr>
<td>150.56</td>
<td>218.47</td>
<td>r = 1</td>
</tr>
<tr>
<td>50.59</td>
<td>83.105</td>
<td>117.71</td>
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<tr>
<td>88.81</td>
<td>92.24</td>
<td>r = 3</td>
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Source: Research findings **Significance in level 95%.

**Table 5 : Result of Simple logarithmic model.**

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<tr>
<th>Independent variable</th>
<th>Egypt</th>
<th>China</th>
<th>Brazil</th>
<th>Algeria</th>
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<td>Intercept</td>
<td>13.79(215.44)**</td>
<td>98.66(0.56)</td>
<td>11.8(2.64)*</td>
<td>6.3(1.762)</td>
</tr>
<tr>
<td>Log(Export price)</td>
<td>6.3(1.762)</td>
<td>-12.087(0.456)**</td>
<td>-0.5211(0.781)**</td>
<td>-1.11(2.106)*</td>
</tr>
<tr>
<td>R²</td>
<td>0.33</td>
<td>0.17</td>
<td>0.27</td>
<td>0.33</td>
</tr>
<tr>
<td>The number of observations</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
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</table>

Source: Research findings *Significant in level 90% **Significant in level 95%.
economical growth theories of national origin income and external direct investment is the major canal to transfer technology from developed countries to importer ones. POP and GDP are positive coefficients and statistically meaningful which economically means that increase in GDP or economical growth increases wheat importing incomes.

In order that applied data in this study was time series, therefore we examine statistical behavior of usable variables by root test at first. The incomes of this test showed that variables of import volume, consumption, and domestic rice price and inflation rate are stagnant with procedure and variable of gross national income are stagnant without procedure. In fact these variables are I(0) and variables of domestic wheat price, oil price and population growth rate became stagnant by differencing the first order and without procedure, in other words these variables are I(1). Since the data was annual, the most gaps consider 1 or 2. In this study gap 1 leads to a better estimation of model and the number of data was less than 100, thus we used Schwarz Bazian criteria in order not to lose independence rank. What’s more, this criterion is more efficient.

Another examination studied here is Joehanson-Joe Silious convergence testing. Its results are shown in Table 4.

Table 4 shows that r=3 is convergence vector and r=1 is convergence vector in level of 95%. Lack of accumulation theory is declined according to these two examinations. And the presence of a vector theory is accepted which indicates a long term equilibrium relation related to oil price variant that affects domestic wheat price. Presence of two convergence vectors is also possible for effect testing that indicates three long term equilibrium relations related to the oil price variable, population and real internal production.

**B: estimation results**

In this section the results of simple and logarithmic models at the method of ordinary least square including consumer surplus and export price of wheat have been shown in four diagram, that number 28 on horizontal axis in figures of 2 and 3 represent the year 2006 and number 29
The year 2007 is represented in figures 4 and 5. The numbers on the vertical axis are based on Trillion dollars.

According to fig.2, the welfare rate in Brazil started a decreasing procedure in 1979 because of an increase in the domestic wheat price and it increased up to 0.52% from 1980 to 1991 due to export price reduction, import volume increasing, and consumer surplus increasing. It intensively decreased in 1991 and increased from 1991 to 2004 and it reduced after that. Welfare rate in Egypt had a uniform and linear procedure, but the amount of consumer surplus increased up to 0.0002% because of an increase in the export wheat price. It is shown in figure 4 that the price rate in China increased up to 12.08% from 1979 to 1984 because of export price reduction, wheat import increasing, domestic wheat price reduction, and consumer surplus increasing. It intensively reduced in 1984 and it had a uniform procedure from 1984 to 1986. It had an intensively increasing procedure. In years 1978, 1986, and 2002, it increased, decreased, and increased respectively. According to fig.5, the welfare rate in Algeria increased up to 1.11% from 1979 to 1989 because of export price reduction, decrease in internal wheat price, internal consumption increasing, and consumer surplus increasing. It intensively decreased in 1984 for the same reasons mentioned for the previous part but vice versa.

Results of the simple logarithm model estimated by OLS including consumer surplus and wheat export price are shown in Table 5.

According to the results from table (5), the wheat price tensile on consumer surplus of four countries is (-1.11), (-0.5211), (-12.087), (-0.0002) which are statistically meaningful in levels of 90%, 95%, 90% respectively. This means if wheat export price increases 1%, the consumer surplus of Algeria, Brazil, China, and Egypt is 1.11%, 0.5211%, 12.078% and 0.0002% respectively and social welfare reduces because of consumer surplus reduction and it affects their benefits rate in the world wheat market.

In this study, wheat importing countries can increase investment in agriculture by optimized financial resource allocation, thus increasing investment in agriculture needs specific attention to facilities of this section in the long term. Keeping inflation rate downward by the government can help to reach this goal, in order to increase domestic wheat production and to have relative benefit in manufacturing this product. If the government applies appropriate price policies in reviewed countries, this will have positive effects on wheat production increasing in the next years. Besides price policies, non-price policies have great efficiency to increase wheat price as reformed seeds which require official structure reformation and culture development are such productive technologies among farmers.

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